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**PATENT**

**ARTICLE PACKAGING SYSTEM**

**CROSS-REFERENCE TO RELATED APPLICATIONS**

**[0001]** The present application is a continuation of U.S. Serial No. 10/266,028, filed October 4, 2002; which is a continuation of U.S. Serial No. 09/866,401, filed May 25, 2001, now abandoned; which is a continuation of U.S. Serial No. 09/785,891, filed February 16, 2001, now U.S. Patent No. 6,311,461, issued November 6, 2001; which is a continuation of U.S. Serial No. 09/393,041 filed September 8, 1999, now U.S. Patent No. 6,189,295, issued on February 20, 2001; which is a continuation of U.S. Serial No. 09/005,630, filed January 9, 1998, now U.S. Patent No. 6,006,500, issued on December 28, 1999; which is a continuation of U.S. Serial No. 08/720,961, filed October 10, 1996, now U.S. Patent No. 5,706,628, issued on January 13, 1998; which is a continuation of U.S. Serial No. 08/462,332, filed on June 5, 1995, now U.S. Patent No. 5,605,029, issued on February 25, 1997; which is a divisional of U.S. Serial No. 08/417,477, filed April 5, 1995, now U.S. Patent No. 5,586,425, issued on December 24, 1996; which is a continuation of U.S. Serial No. 07/954,635, filed on September 30, 1992, now abandoned; the contents of each of which are hereby expressly incorporated herein by reference in their entirety.

## **FIELD OF THE INVENTION**

**[0002]** The present invention relates generally to a system for packaging articles for shipment and more particularly, but not by way of limitation, to a system for automatically packaging potted plants for shipment.

## **BRIEF DESCRIPTION OF THE DRAWINGS**

**[0003]** Figure 1 is a schematic of an article packaging system constructed in accordance with the present invention.

**[0004]** Figure 2 is a plan view of part of the packaging system of Figure 1 showing an automated greenhouse.

**[0005]** Figure 3 is a perspective view of a manual sorting station which may be used in the article packaging system of the present invention.

**[0006]** Figure 4 is a plan view of an automatic sorting station which may be used in the article packaging system of the present invention.

**[0007]** Figure 5 is an elevational view of a gate constructed in accordance with the present invention.

**[0008]** Figure 6 is a plan view of one embodiment of a cover placing station which may be used with the article packaging system of the present invention.

**[0009]** Figure 7 is an elevational view of the cover placing station of Figure 6.

**[0010]** Figure 8 is an enlarged elevational view of a cover placing sub-unit, in position to retrieve a cover.

**[0011]** Figure 9 is the cover placing sub-unit of Figure 8 in position for receiving an article.

**[0012]** Figure 10 is the cover placing sub-unit of Figure 8 shown immediately after receiving an article.

**[0013]** Figure 11 is an elevational view of another embodiment of the cover placing sub-unit, constructed in accordance with the present invention.

**[0014]** Figure 11A is a plan view of the cover placing sub-unit shown in Figure 11.

**[0015]** Figure 12 is an elevational view of another embodiment of the cover placing sub-unit, constructed in accordance with the present invention.

**[0016]** Figure 12A is a plan view of the cover placing sub-unit shown in Figure 12.

**[0017]** Figure 13 is a plan view of yet another embodiment of the cover placing sub-unit, constructed in accordance with the present invention.

**[0018]** Figure 14 is an elevational view of a sleeve constructed in accordance with the present invention.

**[0019]** Figure 15 is an elevational view of part of a sleeving station showing a sleeve before the sleeve is inflated.

**[0020]** Figure 16 is a perspective view of part of the sleeving station of Figure 15 showing an inflated sleeve.

**[0021]** Figure 17 is an elevational view of the sleeving station with parts removed for clarity.

**[0022]** Figure 18 is a plan view of the sleeving station.

**[0023]** Figure 19 is a perspective view of the sleeving station and part of the sealing station.

**[0024]** Figure 20 is an elevational view showing a sealing and a placing station constructed in accordance with the present invention.

**[0025]** Figure 21 is a plan view showing the sealing and placing station of Figure 20.

**[0026]** Figure 22 is a schematic of another embodiment of an article packaging system constructed in accordance with the present invention.

**[0027]** Figure 23 is a side view of the packaging system of Figure 22.

**[0028]** Figure 24A is a perspective view of a sleeving station which may be used in an article packaging system of the present invention.

**[0029]** Figure 24B is a perspective view of the sleeving station of Figure 24A indicating a sleeve positioned to receive a potted plant.

**[0030]** Figure 24C is a perspective view of the sleeving station of Figure 24A after the potted plant has been inserted into the sleeve.

**[0031]** Figure 24D is a perspective view of the sleeving station of Figure 24A showing the sleeved potted plant pushed onto a conveyor.

**[0032]** Figure 25 is a perspective view of a sleeving station modified to push sleeved potted plants directly into a box.

**[0033]** Figure 26 is a perspective view of a sleeving station modified to transfer a sleeved potted plant by lifting it into a box.

**[0034]** Figure 27A is a perspective view of a sleeving station modified to receive a pot cover prior to receiving a potted plant.

**[0035]** Figure 27B is a perspective view of the sleeving station of Figure 27A prepared to receive the potted plant.

**[0036]** Figure 28A is an elevational view of a cover supplying device which may be used in an article packaging system of the present invention.

**[0037]** Figure 28B is a plan view of the cover supplying device of Figure 28A.

**[0038]** Figure 29A is an elevational view of another cover supplying device which may be used in an article packaging system of the present invention.

**[0039]** Figure 29B is a plan view of the cover supplying device of Figure 29A.

**[0040]** Figure 30A is an elevational view of another cover supplying device which may be used in an article packaging system of the present invention.

**[0041]** Figure 30B is an elevational view of the device of Figure 30A after a pot cover has been picked up.

**[0042]** Figure 30C is a perspective view of the device of Figure 30A wherein a sleeve is readied to receive the pot cover.

**[0043]** Figure 30D is a perspective view of the device of Figure 30A wherein the pot cover has been inserted into the sleeve.

**[0044]** Figure 31 is a plan schematic view of another article packaging system of the present invention.

**[0045]** Figure 32 is an elevational view of a mobile sleeving station for use with an article packaging system such as that in Figure 31.

**[0046]** Figure 33 is a plan view of a boxing system for use in an article packaging system of the present invention.

**[0047]** Figure 34 is a plan view of a portion of another article packaging system in which a cover is applied directly to an article by a cover forming apparatus.

## **DESCRIPTION OF THE PREFERRED EMBODIMENTS**

**[0048]** The present invention, an article packaging system, is described herein as being adapted to process potted plants. However, a potted plant represents only one article which can be processed with the present invention and the present invention specifically contemplates various and numerous other types of articles such as: vases, hats (including cowboy hats, fedoras, caps, derbies, sombreros, fezzes and helmets), rose stem boxes, flower pots, candy trays, baskets (such as Easter or decorative baskets), corsage boxes, containers, and various other articles. The term "article" as used herein is intended to encompass all of the specific articles just mentioned and the term "article" also is intended to be broad enough to encompass any other article which may be decorated, sleeved, and then packed for shipping.

**[0049]** The term "potted plant" as used herein means a botanical item and the pot, such as a flower pot, within which the botanical item is contained. The potted plant has potting soil or any other growth medium or filler, such as foam, known in the art to secure a plant or other botanical item within a pot. One end of the botanical item is secured in the pot and the other end exposed through the opening in the flower pot. The potted plant has an exterior surface comprising the outer surface of the pot, about which a decorative cover may be placed or applied.

**[0050]** The term "botanical item" as used herein means a natural or artificial herbaceous or woody plant, taken singly or in combination. The term "botanical item" also means any portion or portions of natural or artificial herbaceous or woody plants including stems, leaves, flowers, blossoms, buds, blooms, cones, or roots, taken singly or in combination, or in groupings of such portions such as bouquet or floral grouping. The term "propagule" as used herein means any structure capable of being propagated or acting as an agent of reproduction including seeds, shoots, stems, runners, tubers, plants, leaves, roots or spores. The term "growing medium" used herein means any liquid, solid or gaseous material used for plant growth or for the cultivation of propagules, including organic and inorganic materials such as soil, humus, perlite, vermiculite, sand, water, and including the nutrients, fertilizers or hormones or combinations thereof required by the plants or propagules for growth. The term "flower pot" means any type of floral container used to hold a botanical item. Examples of flower pots used in accordance with the present invention include clay flower pots, plastic flower pots, and flower pots comprised of other natural or synthetic materials.

**[0051]** The present invention particularly contemplates the preparation of potted plants for shipment. More particularly a potted plant may be covered with a formed sheet of decorative material formed into a decorative cover having an interior surface, exterior surface and an interior space adjacent and

surrounded by the interior surface such as that formed in a mold type article forming system described in detail in U.S. Patent No. 4,773,182, issued to Weder et al. on September 27, 1988, and which is hereby specifically incorporated herein by reference.

**[0052]** A decorative pattern, such as a color and/or an embossed pattern, and/or other decorative surface ornamentation may be applied to the upper surface and/or the lower surface of the sheet of material comprising the decorative cover or portions thereof including, but not limited to printed design, coatings, colors, flocking or metallic finishes. The sheet of material comprising the cover also may be opaque, translucent, or totally or partially clear or tinted transparent material.

**[0053]** The sheet of material may be constructed of a single sheet of material or a plurality of sheets. Any thickness of the sheet of material may be utilized in accordance with the present invention as long as the sheet of material may be wrapped about at least a portion of a flower pot or deposited within a sleeve, as described herein. The sheet of material may have a thickness of less than about 1 mil to about 30 mils. Typically, the sheet of material has a thickness in a range of less than about 0.2 mil to about 10 mils. In a preferred embodiment, the sheet of material is constructed from one sheet of man-made organic polymeric film having a thickness in a range of from less than about 0.5 mil to about 2.5 mils.

**[0054]** The sheet of material is constructed from any suitable material that is capable of being wrapped about a flower pot. Preferably, the sheet of material comprises paper (untreated or treated in any manner), cellophane, foil, synthetic organic polymeric film, fiber (woven or nonwoven or synthetic or natural), cloth (woven or nonwoven or natural or synthetic), burlap, or any combination thereof.

**[0055]** The term "synthetic organic polymeric film" means a synthetically made resin such as a polypropylene as opposed to naturally occurring resins such as cellophane. A synthetic organic polymeric film is relatively strong and not as subject to tearing (substantially non-tearable), as might be the case with paper or foil. The synthetic organic polymeric film is a substantially linearly linked. Such films are synthetic polymers formed or synthesized from monomers. Further, a relatively substantially linearly linked processed organic polymeric film is virtually waterproof which may be desirable in many applications involving wrapping botanical items or potted plants.

**[0056]** Additionally, a relatively thin film of substantially linearly linked processed organic polymer does not substantially deteriorate in sunlight. Processed organic polymeric films having carbon atoms both linearly-linked and cross-linked, and some cross-linked polymeric films, also may be suitable for use in the present invention provided such films are substantially flexible and can be made in a sheet-like format for wrapping purposes consistent with the

present invention. For example, one such man-made organic polymeric film is a polypropylene film.

**[0057]** The sheet of material may vary in color. Further, the sheet of material may consist of designs which are printed, etched, and/or embossed; in addition, the sheet of material may have various colorings, coatings, flocking and/or metallic finishes, or be characterized totally or partially by pearlescent, translucent, transparent, iridescent, or the like, characteristics. Each of the above-named characteristics may occur alone or in combination. Moreover, each surface of the sheet of material may vary in the combination of such characteristics.

**[0058]** The sheet of material has a width extending generally between the first side and the second side respectively, sufficiently sized whereby the sheet of material can be wrapped about and substantially surround and encompass a flower pot. The sheet of material has a length extending generally between the third side and the fourth side, respectively, sufficiently sized whereby the sheet of material extends over a substantial portion of the flower pot when the sheet of material has been applied about the flower pot in accordance with the present invention shown and described in detail herein.

**[0059]** The sheet of material may further comprise at least one scent. Examples of scents utilized herein include (but are not limited to) floral scents (flower blossoms, or any portion of a plant), food scents (chocolate, sugar,

fruits), herb or spice scents (cinnamon), and the like. Additional examples of scents include flowers (such as roses, daisies, lilacs), plants (such as fruits, vegetables, grasses, trees), foods (for example, candies, cookies, cake), food condiments (such as honey, sugar, salt), herbs, spices, woods, roots, and the like, or any combination of the foregoing. Such scents are known in the art and are commercially available.

**[0060]** The scent may be disposed upon the sheet of material by spraying the scent thereupon, painting the scent thereupon, brushing the scent thereupon, lacquering the scent thereupon, immersing the sheet of material to scent-containing gas, or any combination thereof.

**[0061]** The scent may be contained within a lacquer, or other liquid, before it is disposed upon the sheet of material. The scent may also be contained within a dye, ink, and/or pigment (not shown). Such dyes, inks, and pigments are known in the art, and are commercially available, and may be disposed upon or incorporated in the sheet of material by any method described herein or known in the art.

**[0062]** The decorative cover may be bonded to the article or potted plant by a bonding material. The term "bonding material" as used herein means an adhesive, preferably a pressure sensitive adhesive, or a cohesive. Where the bonding material is a cohesive, a similar cohesive material must be placed on the adjacent surface for bondingly contacting and bondingly engaging with the

cohesive material. The term "bonding material" also includes materials which are heat sealable, sonic sealable and, vibratory sealable in these instances, the adjacent portions of the material must be brought into contact and then heat, sound waves or vibrations, respectively, must be applied to effect the seal.

**[0063]** The term "bonding material" as used herein also means a heat sealing lacquer which may be applied to the sheet of material and, in this instance, heat also must be applied to effect the sealing. The term "bonding material" as used herein means any type of material or thing which can be used to effect the bonding or connecting of the two adjacent portions of the material or sheet of material to effect the connection or bonding described herein. The term "bonding material" also includes ties, labels, bands, ribbons, strings, tape, staples or combinations thereof.

**[0064]** The decorated article covered with a decorative cover may then be placed in a sleeve to generally protect it during shipping. For example, a potted plant may be sleeved to preserve water and carbon dioxide for the plant, and to protect the plant during shipping. The sleeve may be made from an impermeable material which would retain all gases and liquids or from a semi-permeable material, such as a material which would allow oxygen and carbon dioxide to pass, but would inhibit the passage of water through the material.

**[0065]** Sleeves are well known in the art of packaging potted plants. As used herein, a sleeve is cylindrical, conical or frusto-conical in shape and has

an upper opening, which provides an opening for the deposit of a potted plant, or other article, therein. Sleeves may be comprised of any flexible material suitable for covering a potted plant, including materials selected from a group of materials, comprising paper, metal, foil cloth (natural or synthetic), denim, burlap, or polymeric film, or combinations thereof. The term polymeric film as used herein means any polymeric film, including for example, but not by way of limitation, polypropylene film and cellophane. The material comprising the sleeve may be opaque, translucent, or totally or partially transparent and may be decorated with designs or tints.

**[0066]** The article, after having been placed in a sleeve, may then be placed in a container for shipping. The container, such as a box, carton or crate, may then be sealed and marked for easy identification. The present invention provides an automated line for preparing articles for shipping in the manner just described thereby saving the seller considerable labor expense and reducing the preparation time required for packaging articles.

**[0067]** In describing the preferred embodiment, a potted plant will be used as an example of the article being processed. However, as discussed above the invention may be used on various other articles.

## **EMBODIMENTS OF FIGURES 1-21**

**[0068]** Turning now to Figure 1, an article packaging system designated by the reference numeral 10 is shown which is constructed in accordance with the present invention. The article packaging system 10 is adapted to transport an article from a storage location, place a decorative cover over or around the article, place the covered article in a sleeve, and pack the sleeved article in a carton for shipping.

**[0069]** A storage location such as a greenhouse, hereby designated by the reference numeral 12, supplies potted plants 14 (Figure 3) for processing. The greenhouse 12 is a frame covered with a material which will allow the radiant energy from the sun to reach the potted plants 14 which are grown inside. Such structures are common in the art. Within the greenhouse 12 are growing racks 16 (Figure 2) adapted for holding the potted plants 14 while they are grown. The greenhouse 12 may be automated by installing conveyors 18 and 20 (also shown in Figure 2) adapted for transporting the potted plants 14 into and out of the greenhouse 12. Conveyors 18 and 20 may also serve as additional growing racks. Each conveyor 18 or 20 should be reversible so it may serve to bring potted plants 14 into the greenhouse 12 or supply potted plants 14 from the greenhouse 12. Each conveyor 18 or 20 may be similar in construction. The construction details of the conveyors 18 and 20 are not required herein as they are well known to persons of ordinary skill in the art.

**[0070]** As indicated in Figure 1, a conveyor 22 extends from the greenhouse 12 to a sorting station 24. The sorting station 24 may be a manual sorting station 26 (Figure 3) or an automatic sorting station 28 (Figure 4). The manual sorting station 26 comprises a table 30 which receives the potted plants 14 from the conveyor 22. An operator (not shown) standing near the table 30 may select the potted plant 14, in accordance with a predetermined grading criterion such as size and grade, and place it on a conveyor 32 or a conveyor 34 with other potted plants (not shown) of a similar grade. The potted plants 14 are sorted into one of at least two grades. Conveyors 32 and 34 should begin near the manual sorting station 26 and transport the potted plants 14 to the next area for further processing.

**[0071]** In an alternative embodiment (not shown), the manual operator at the manual sorting station 26 may select potted plants 14 directly from the conveyor 22 and grade and place them directly from the conveyor 22 to conveyors 32 and 34, thereby eliminating the need for the table 30.

**[0072]** In the automatic sorting station 28 of Figure 4, the automatic sorting station 28 may be any one several apparatuses for sorting the potted plants 14. One embodiment of the automatic sorting station 28 is shown in Figure 4 and comprises a first positioning gate 36 and a second positioning gate 38, a light source assembly 40, a light sensor assembly 42 which is comprised of at least one sensing device such as a photoelectric cell 43 and a support

backing 44, a light switch 45 and a gate 46, all located near the discharge end of the conveyor 22.

**[0073]** Referring now to Figures 4 and 5, the first and second positioning gates 36 and 38 are similar in construction. Each positioning gate 36 and 38 has an arm 48 (Figure 5). The arm 48 is preferably made from a strip of stainless steel about four to eight inches tall and of sufficient length to reach half way across conveyor 22. One end of the arm 48 is secured as by welding to a rod 50. The rod 50 extends up from the arm 48 through a bearing 52, to a motor 54. A collar 56 is secured to the rod 50 above the bearing 52 by a set screw 58, thereby holding the arm 48 off the upper surface of the conveyor 22. The bearing 52 is secured to a brace 60 which is mounted to the side of the conveyor 22.

**[0074]** The first and second positioning gates 36 and 38 are secured to opposite sides of the conveyor 22 and they work in conjunction to release potted plants 14 at regular intervals. In addition to spacing the potted plants 14 along the conveyor 22, the first and second positioning gates 36 and 38 also position the potted plants 14 generally in the center of conveyor 22. Therefore, all potted plants 14 are positioned approximately the same distance from the light sensor assembly 42 as they pass in front of it.

**[0075]** With continued reference to Figure 4, the light source assembly 40 is comprised of a housing 62 having a slot 64 formed on the side adjacent the

conveyor 22. The housing 62 is secured on one side of the conveyor 22 such that the slot 64 is on the side of the housing 62 which faces the conveyor 22. At least one light source 66, such as a light bulb, is secured within the housing 62 so that light emitted by the light source 66 passes through the slot 64 and across the conveyor 22.

**[0076]** Directly across conveyor 22 from the light source assembly 40 is the light sensor assembly 42.

**[0077]** The light switch 45 is located in front of the light source assembly 40 and turns on the light source 66 when the potted plant 14 is between the light source assembly 40 and the light sensor assembly 42. Since the potted plant 14 is between the light source assembly 40 and the light sensor assembly 42 when the light source 66 is turned on, the amount of light reaching the light sensor assembly 42 depends upon the size and density of the foliage on the potted plant 14. The taller and more dense the foliage, the less light reaches light sensor assembly 42.

**[0078]** The gate 46 is located downstream from the light sensor assembly 42 near the end of the conveyor 22. The gate 46 is similar in construction to the first positioning gate 36. The brace 60 of gate 46 is positioned over the center of the conveyor 22. The gate 46 is pivoted to a first position 68 or a second position 70 depending on the amount of light hitting the light sensor assembly 42. The action of the gate 46 is controlled by a control assembly (not

shown) which detects the degree of light detected by the photoelectric cell 43 and responds accordingly.

**[0079]** While the potted plant 14 is between the light source 66 and the photoelectric cell 43, the potted plant 14 may be rotated by a rotating device (not shown). In this way light can be sensed and measured at several points of rotation of the foliage of the potted plant 14, thereby measuring an average amount of detected light which may provide a more accurate grading system for the foliage of the potted plants 14. Alternatively, instead of being rotated, several light readings could be measured at several points along the conveyor 22, for example, with the light readings taken at different angles to the foliage, to derive an average of the several readings.

**[0080]** Directly downstream from the gate 46 is a positioning bar 72. The positioning bar 72 is V-shaped and is positioned so the point of the V is directly downstream from the brace 60 of the gate 46. A first end 74 and a second end 76 of the bar 72 extend off a side of the conveyor 22 and onto an adjacent conveyor 32 or 34. The first end 74 of the bar 72 extends from the conveyor 22 to the conveyor 34. The second end 76 of the bar 72 extends from the conveyor 22 to the conveyor 32. Conveyors 32 and 34 may lead to similarly constructed processing lines and thus, only one such line is described below.

**[0081]** In an alternative embodiment (not shown), the potted plants 14 can be graded on the basis of the difference between a known tare weight of the

pot and soil and the weight of potted plant 14. If the tare weight of the pot and saturated soil contained therein is known, this measurement can be subtracted from the weight of a potted plant having saturated soil. The difference in weight is an approximate measure of the weight of the plant. This enables the classification, or grading, of the potted plant 14 on the basis of the criterion of weight, rather than of the basis of the amount of light reaching a light sensor 42, which represents foliage density.

**[0082]** Other automatic methods of grading the potted plants 14 are to use other forms of electromagnetic radiation such as radar (not shown) or an infrared light sensing device (not shown) which grades the plant by detecting the amount of heat the plant gives off.

**[0083]** The embodiment of the article processing system described herein envisions only a single sorting station 24 to grade the potted plants 14. However, it will be appreciated by one of ordinary skill in the art that additional sorting stations 24 could be located downstream of either conveyor assemblies 32 or 34 to provide additional grading of the potted plants 14.

**[0084]** The conveyor 32 moves the potted plants 14 to a covering station 82. The covering station 82 may be embodied in a variety of different forms as described and shown below.

**[0085]** In the embodiment shown in Figures 6 and 7, the covering station 82 includes a first gate 84 and a second gate 86, a turnstile 88 and a cover

denesting sub-unit 90. The first and second gates 84 and 86 are secured to opposite sides of the conveyor 32 and work in conjunction to release potted plants 14 at regular intervals. In addition to spacing the potted plants 14 along the conveyor 32, the first and second gates 84 and 86 also position the potted plants 14 in the center of conveyor 32. Therefore, all potted plants 14 are positioned to be received by the turnstile 88.

**[0086]** The turnstile 88 and the cover denesting sub-unit 90 may be mounted on a platform 92 with a plurality of locking casters 94 (Figure 7). Thus, the turnstile 88 and the cover denesting sub-unit 90 may be rolled to the side and replaced with a section of conveyor (not shown) when covering the article is not a required step.

**[0087]** The turnstile 88 has a conduit 98 with a first end 100 and a second end 102. The first end 100 is secured to the platform 92. The turnstile 88 has a turnstile axle 104 which has a first end 106 and a second end 108. The second end 102 of the conduit 98 is open for accepting the first end 106 of the turnstile axle 104. The diameter of the first end 106 of the turnstile axle 104 is slightly smaller than the diameter of the lumen in the conduit 98. This allows the turnstile axle 104 to rotate freely within the conduit 98.

**[0088]** A drive assembly mount 110 is secured near the second end 102 of the conduit 98. Secured to the drive assembly mount 110 is a drive assembly 112 with a rotatable shaft 114. Secured to the rotatable shaft 114

is a first gear 116. A second gear 118 is secured to the turnstile axle 104 between the first end 106 and the second end 108 thereof, and in a position such that the first gear 116 and the second gear 118 mesh.

**[0089]** Secured near the second end 108 of the turnstile axle 104 are four transfer assemblies 120A, 120B, 120C and 120D. Each transfer assembly 120A-120D includes a carrying unit 121, a brace 122, and a cylinder 123. The brace 122 has a first end 124 and a second end 125. Each carrying unit 121 comprises a first arm 126 and a second arm 128 (Figures 6-7).

**[0090]** The first end 124 of the brace 122 is secured to the turnstile axle 104 and is adapted for supporting the cylinder 123. The cylinder 123 is secured to the second end 125 of the brace 122.

**[0091]** Secured to the cylinder 123 are the first and second arms 126 and 128 of the carrying unit 121. The cylinder 123 is adapted to reciprocatingly raise and lower the carrying unit 121.

**[0092]** Referring now to Figures 6-10, also secured to the platform 92 is an automatic cover supplying assembly, also referred to as the cover denesting sub-unit 90. The cover denesting sub-unit 90 includes a cover dispenser housing 130 and a cover dispenser support 132 having a base 133. The cover dispenser support 132 is adapted for supporting the cover dispenser housing 130 over the platform 92. The cover denesting sub-unit 90 also includes a conveyor with a first parallel belt 134 and a second parallel belt

136. The first and second parallel belts 134 and 136 are placed around rollers 138 and 140 (Figure 7), and are spaced apart to provide a gap 142 lengthwise for enabling the placement of a retrieved cover into a potted plant application position.

**[0093]** A conveyor 144 having a first end 146 and a second end 148 (Figure 19) is abutted at its first end 146 to the end of the belts 134 and 136 in a position to receive a cover 158 or a covered potted plant from belts 134 and 136.

**[0094]** A suction support arm 150 is generally L-shaped and is pivotally secured at a first end 151 near the base 133 of the cover dispenser support 132. The suction support arm 150 has a free end 153.

**[0095]** A cylinder 152 extends between the platform 92 and the suction support arm 150 and is slidingly secured to the suction support arm 150 by a bracket 154. The cylinder 152 and bracket 154 are adapted for raising the suction support arm 150 so a suction cup 156, which is connected to the free end 153 (Figure 8) of the suction support arm 150, is raised to a position for removing the cover 158 (Figures 8-10) from the cover dispenser housing 130.

**[0096]** Secured to the platform 92 directly below the suction support arm 150 is a vacuum valve 160 and a support spring 162. A vacuum line 164 extends from the suction cup 156 to the vacuum valve 160 and on to a vacuum

source (not shown). Operational details of the cover denesting subunit 90 are described below in the In Operation section.

**[0097]** An alternate cover denesting sub-unit (automatic cover supplying assembly) embodiment, herein designated by the reference numeral 90A, is shown in Figures 11-11A. This embodiment uses an article forming system 165, such as is disclosed in U.S. Patent No. 4,773,182, the specification of which is hereby incorporated herein by reference. The article forming system 165 places covers on a suction cup 156A. The suction cup 156A is supported by a rod 166 which extends up between a first parallel belt 134A and a second parallel belt 136A in a fashion similar to the suction support arm 150 described above. This embodiment also includes a vacuum valve 160A and a support spring 162A.

**[0098]** Another cover denesting sub-unit embodiment, herein designated by the reference numeral 90B, is shown in Figs 12 and 12A. In this embodiment, the article forming system 165 places a cover (not shown) on a table 168, and a turnstile (not shown), then places a potted plant (not shown) into the cover (not shown). Alternatively, a potted plant may be placed manually within the cover. A pusher assembly 170 comprised of a cylinder 171 and a pushing arm 172 then pushes the covered potted plant (not shown) onto the conveyor 144.

**[0099]** Another cover denesting sub-unit embodiment, herein designated by the reference numeral 90C, is shown in Fig 13. The cover denesting sub-unit 90C uses a first gate 174 and a second gate 176 to hold a cover (not shown) stationary on the moving conveyor 144. Once the potted plant (not shown) is in the cover (not shown), the first and second gates 174 and 176 open, allowing the covered potted plant (not shown) to proceed down conveyor 144 for further processing.

**[0100]** At some point after the cover 158 has been denested and positioned, a potted plant 14 is placed into the interior space of the cover 158 producing a covered potted plant 180 (Figure 7). The potted plant 14 may be placed into the cover 158 manually or automatically. The covered potted plant 180 is conveyed down conveyor 144 toward the second end 148, where it is transferred to an automatic sleeving station 184 for application of a sleeve about the covered potted plant 180 to form a sleeved covered potted plant.

**[0101]** Referring now to Figures 1 and 17-19, the sleeving station 184 includes a guiding assembly comprising a first spring-loaded guide 186 and a second spring-loaded guide 188. The first and second spring-loaded guides 186 and 188 (Figure 18) receive the covered potted plant 180 as it moves from the second end 148 of the conveyor 144. A brace 190 is secured above the first and second spring-loaded guides 186 and 188 to keep the potted plant 180 upright as it moves in direction 192 (Figure 17) through the first and second

spring-loaded guides 186 and 188. Below the first and second spring-loaded guides 186 and 188 are a first wicket 194 and a second wicket 196 for holding a plurality of sleeves, such as a sleeve 198 (Figures 14-16) and described in detail below. Each wicket 194 and 196 has a first end 200 and a second end 202 (Figure 19). The first end 200 is secured to a brace (not shown) and extends downwardly at an angle to a point 206 between the first end 200 and the second end 202. From the point 206 to the second end 202, the wickets 194 and 196 extend horizontally or slightly downward.

**[0102]** As is shown in Figures 14-16, each sleeve 198 has a front side 208 having a height 210, and a back side 212 having a height 214. The height 210 of the front side 208 of the sleeve 198 is less than the height 214 of the back side 212 of the sleeve 198. Holes 216 and 218 are formed in the upper corners of the back side 212 of each sleeve 198. Although the sleeve 198 is shown in Figures 14-17 as tubular, the shape of the sleeve 198 may be any variety of shapes but the preferred embodiment is frusto-conical. Additionally, in an alternative embodiment, heights 210 and 214 may be the same and the holes 216 and 218 may extend through both the front and back sides 208 and 212 of each sleeve 198.

**[0103]** Referring now in particular to Figures 15 and 16, the first and second wickets 194 and 196 extend through the holes 216 and 218, respectively, to support the sleeve 198. The wickets 194 and 196 are secured

so that the sleeve 198 is pulled by gravity down the wickets 194 and 196 until the backside 212 of the sleeve 198 comes into contact with an automatic sleeve opening assembly comprising an inflator tube 220 (Figure 16). Air exiting the inflator tube 220 opens and inflates the sleeve 198.

**[0104]** In an alternative embodiment of the sleeve opening assembly, suction cups (not shown) may be employed to pull open the front side 208 of the sleeve 198 to allow the air blast from the inflator tube 220 and to more easily access and open the sleeve 198.

**[0105]** As the covered potted plant 180 reaches the end 148 of the conveyor 144 and moves in direction 192 through the chute between the first and second spring-loaded guides 186 and 188 and the brace 190, it is deposited into the open sleeve 198 (Figure 19) to provide a sleeved potted plant 222 (also referred to in this instance as a sleeved covered potted plant).

**[0106]** In an alternative embodiment (not shown), the covered potted plant 180 may be formed into the sleeved covered potted plant 222 by wrapping a sheet of sleeving material (not shown) about the covered potted plant automatically.

**[0107]** Referring now to Figures 1, 20 and 21, a gripping station 230, also referred to as a transfer station, is positioned to remove the sleeved potted plant 222 from the wickets 194 and 196. The gripping station 230 comprises a turnstile 234, a first gripping arm 236 and a second gripping arm 238. The

turnstile 234 further comprises a conduit 240 with a first end 242 and a second end 244. The first end 242 of the conduit 240 is secured to a base 246. The second end 244 of the conduit 240 is open for accepting a first end (not shown) of a turnstile axle 250. The turnstile axle 250 has a first end (placed inside the conduit 240) and a second end 254. The diameter of the turnstile axle 250 is slightly smaller than the diameter of the opening in the conduit 240. This allows the turnstile axle 250 to rotate freely within the conduit 240.

**[0108]** A drive assembly bracket 256 is secured near the second end 244 of the conduit 240. Secured to the drive assembly bracket 256 is a drive assembly 258, such as a motor. The drive assembly 258 has a rotatable shaft 260. Secured to the rotatable shaft 260 is a first gear 262. A second gear 264 is secured to the turnstile axle 250 in a position such that the teeth on the first gear 262 mesh with teeth of the second gear 264.

**[0109]** Secured to the second end 254 of the turnstile axle 250 are support arms 266A, 266B, 266C and 266D. Each support arm 266A-266D includes the first gripping arm 236 and the second gripping arm 238. Connected to each support arm 266A-266D is a cylinder 270 adapted for closing the first gripping arm 236 and the second gripping arm 238 together against the upper end of the sleeve 198 of the sleeved potted plant 222.

**[0110]** In an alternative embodiment, the first gripping arm 236 includes a heating element (not shown) adapted to seal the upper end of the sleeve 198

of the sleeved potted plant 222 when the upper end is compressed between the gripping arms 236 and 238 thereby forming a sealed sleeved potted plant 272. The gripping arms 236 and 238 grasp the sealed sleeved potted plant 272, thereby freeing the sealed sleeved potted plant 272 from the wickets 194 and 196. From there, the support arm 266 carries the sealed sleeved potted plant 272 to a placing station 274 (Figures 1, 20-21). The upper portion of the sleeve 198 may alternately be sealed by gripping arms 236 and 238 which comprise sonic elements, vibratory elements or pressure-sensitive elements.

**[0111]** Positioned to receive the sleeved potted plant 222 or the sealed sleeved potted plant 272 is the placing station 274 (Figures 20-21). The placing station 274 comprises a lowering arm 276, a first pinching arm 278, a second pinching arm 280 and a cylinder 282.

**[0112]** The lowering arm 276 is reciprocatingly secured to the cylinder 282 such that the lowering arm 276 may be reciprocatingly lowered and raised. The first pinching arm 278 is pivotally secured opposite the pinching arm 280 of the lowering arm 276. The pinching arms 278 and 280 first receive the sleeved potted plant 222 or the sealed sleeved potted plant 272 at a receiving position 284 (Figure 21). A small cylinder 288 is secured between the lowering arm 276 and the first pinching arm 278. The cylinder 288 is adapted to allow the pinching arms 278 and 280 to grasp and release the sealed sleeved potted plant 272 or the sleeved potted plant 222.

**[0113]** The cylinder 282 is suspended from a rail 290. The rail 290 has a first end 292 and a second end 294. Secured to the first end 292 of the rail 290 is a motor 296 with rotatable shaft 298. Secured to the rotatable shaft 298 is a sprocket 300. On the second end 294 of the rail 290 is an idler sprocket 302. A continuous loop of chain 304 extends around the first sprocket 300 and the second sprocket 302. The cylinder 282 is secured to the chain 304 so that upon rotating the shaft 298, the cylinder 282 is moved along the rail 290 to a predetermined position for lowering the grasped sleeved potted plant 222 or the sealed sleeved potted plant 272 into a box or carton 306.

**[0114]** A carton placing conveyor 308 is adapted to move the carton 306 into position for receiving the sleeved potted plant 222 or the sealed sleeve potted plant 272. Once the carton 306 is full the conveyor 308 removes the carton 306 from the packing area. Cartons, like carton 306, are supplied from a carton folding station 310 (Figure 1). Many commercially available carton folders are suitable, and therefore, need not be described herein. Alternatively, cartons 306 may be supplied manually.

### **In Operation**

**[0115]** Articles 14, which may be potted plants as shown, for example in Figure 3, are placed on the conveyor 22, then are moved to the sorting station 24 (Figure 1). If the sorting station 24 is a manual sorting station 26, such as

shown in Figure 3, an operator (not shown) will select articles 14 to be packaged together, and place them on the conveyor 32 or 34, which will carry the articles 14 to the next station.

**[0116]** If the sorting station 24 is the automatic sorting station 28, such as shown in Figure 4, the articles 14 will travel down conveyor 22 until they come in contact with positioning gates 36 and 38. The positioning gates 36 and 38 will hold an article 14 until a predetermined distance 312 between the article 14 and a previous article 14a has been achieved. Once the distance 316 between the article 14 and the previous article 14a has been achieved, positioning gates 36 and 38 will open allowing the article 14 to proceed on to the light sensor assembly 42.

**[0117]** Since the positioning gates 36 and 38 open simultaneously, the article 14 will be centered on the conveyor 22, and thus, all articles 14 will be the same distance from the light sensor assembly 42 as they pass in front of it. As the article 14 passes in front of the light sensor assembly 42, the article 14 comes into contact with and moves the light switch 45. Movement of the light switch 45 activates the light source 66 in the housing 62.

**[0118]** Light leaving the housing 62 through the slot 64 will be partially absorbed and partially reflected by the article 14. Thus, the larger and more dense the article 14, the less light will reach the photoelectric cell 43. In this way, smaller or less dense articles 14 may be distinguished from larger or

denser articles 14. If the article 14 is small, the gate 46 will swing into the first position 68 and if the article 14 is large, the gate 46 will swing into the second position 70, as determined by a control assembly (not shown). As the article 14 comes into contact with the gate 46, it is directed to one side of the positioning bar 72. The positioning bar 72 further directs the article 14 onto an adjacent conveyor, such as conveyor 32. Alternately, the article 14 may be sorted after a decorative cover has been applied.

**[0119]** If the article 14 is to receive a decorative cover, which in the case of a potted plant would be a flower pot cover, the covering station 82 will be positioned at the end of the conveyor 32. The article covering station 82 is mounted on the platform 92 with the locking casters 94. Thus, if no covering is required, the covering station 82 may simply be rolled to the side and a section of conveyor (not shown) may take its place. Assuming that covering is desired, any of the several embodiments may be used with ease.

**[0120]** In the preferred operational embodiment, the article 14 will first encounter the first and second gates 84 and 86 (Figures 6-7). The first and second gates 84 and 86 hold the article 14 until the turnstile 88 is in position to accept the article 14, that is, when transfer assembly 120A is in line with conveyor 32. As soon as the article 14 has entered the arms 126 and 128 of the carrying unit 121, the carrying unit 121 is raised by the cylinder 123 and the turnstile 88 begins to turn in a counterclockwise direction 314 (Figure 6).

**[0121]** When the transfer assembly 120A is in a position 316 (Figure 6), the suction support arm 150 is raised by the cylinder 152 (see Figure 8). By the time the transfer assembly 120A has reached a position 318, the suction support arm 150 has been lowered by the cylinder 152, suctionly bringing with it the cover 158 from the cover dispensing housing 130 (see Figure 9). When the transfer assembly 120A reaches a position 320 (Figure 6), the turnstile 88 momentarily stops over the cover 158 while the cylinder 124 lowers the carrying unit 121, thereby lowering the article 14 into the cover 158. The weight of the article 14 and cover 158 depress the support spring 162, thus lowering the covered article 180 onto conveyor belts 134 and 136 (see Figure 10).

**[0122]** As the support spring 162 is depressed, the vacuum valve 160 is deactivated, thereby causing the suction cup 156 to release the cover 158 and allowing the covered article 180 to rest upon the conveyor belts 134 and 136. The conveyor belts 134 and 136 direct the covered article 180 toward conveyor 144 (Figure 7), and thus out of the carrying unit 121. As the turnstile 88 resumes rotation, and as the transfer assembly 120A passes through a position 322 (Figure 6), cylinder 124 retracts the carrying unit 121, thereby raising the first arm 126 and the second arm 128 of the carrying unit 121 into position for receiving the next article 14 from the conveyor 32.

**[0123]** The covered article 180 is directed from the first and second parallel belts 134 and 136 to the conveyor 144 (Figure 7), and continues to the sleeving station 184 (Figure 17). As the covered article 180 reaches the second end 148 of the conveyor 144, it drops gravitationally through the pair of spring-loaded guides 186 and 188 (Fig 18). The brace 190 supports the upper side of the covered article 180 as it drops from the conveyor 144 thereby maintaining the vertical positioning of the covered article 180 as it drops. The spring-loaded guides 186 and 188 guide the covered article 180 into the opened sleeve 198 (Figure 19).

**[0124]** As is shown in Figure 16, a supply of sleeves 198 is supported on wickets 194 and 196, and are gravitationally fed to the inflator tube 220. The end of the inflator tube 220 comes into contact with the back side 212 (Figure 16) of the first sleeve 198 in the supply, thus keeping the supply of sleeves 198 from sliding down the wickets 194 and 196. Air exiting from the inflator tube 220 inflates the lowermost sleeve 198 in preparation for receiving a covered article 180. The added weight of the covered article 180 dropping from the conveyor 144 causes the opened sleeve 198 to sag, thus releasing it from the inflator tube 220 and enabling it to slide down wickets 194 and 196 to the horizontal section of the wickets 194 and 196 (Figure 19). After the first sleeve 198 is removed another sleeve 198 moves into position to be inflated. The first sleeve 198 containing the covered article 180, now constituting a sleeved

covered article 222, is grasped by first and second gripping arms 236 and 238 (Figure 19) of the gripping (transfer) station 230 (Figures 20 and 21).

**[0125]** The turnstile 234 then rotates, thus pulling the sleeve 198 from the wicket 194 and 196. In one embodiment, as the turnstile 234 continues to rotate, heating elements (not shown) in the first gripping arm 236 heat the gripped portions of the sleeve 198, sealing the front and the back sides 208 and 212, respectively, of the sleeve 198 of the sleeved covered article 222 (Figure 21) to form the sealed sleeved covered article 272. In one version, the sleeve 198 is not sealed over the sleeved covered article 222. As the turnstile 234 rotates 180 degrees to the receiving position 284, the first and second gripping arms 236 and 238, still carrying the sleeved covered article 222 or the sealed sleeved article 272 (as the case may be), move between the first pinching arm 278 and the second pinching arm 280 of the placing station 274 (Figures 20-21).

**[0126]** Once the first and second gripping arms 236 and 238 are between the first pinching arm 278 and the second pinching arm 280, the first and second pinching arms 278 and 280 close to pinch the sleeve 148 of the sleeved covered article 222 or of the sealed sleeved covered article 272 (as the case may be) and the first and second gripping arms 236 and 238 are opened slightly. Thus, the sleeved potted plant 222 or the sealed sleeve potted plant 272 is now held by the first and second pinching arms 278 and 280 of the

placing station 274. Immediately thereafter, the cylinder 282 is pulled along the rail 290 via the motor 296 and chain 304 (Figures 20-21) from the receiving position 284 to the position 326 and the sleeved potted plant 222 or the sealed sleeved potted plant 272 is lowered into the carton 306. The first and second pinching arms 278 and 280 are then released and the lowering arm 276 is raised and returned to the receiving position 284 to accept the next sleeved potted plant 222 or sealed sleeved potted plant 272.

**[0127]** Each sleeved potted plant 222 or sealed sleeved potted plant 272 is received and placed in the carton 306. Placing of the article 222 or 272 in the carton 306 may be manually or automatically controlled (control mechanism not shown). The conveyor 308 moves as necessary to allow placing of the sleeved potted plant 222 or the sealed sleeved potted plant 272 in the carton 306.

**[0128]** This cycle repeats until the carton 306 is full. At that time, conveyor 308 carries away the full carton 306 and replaces it with a new container 306. The full carton 306 eventually reaches a carton closing station 330 (Figure 1) and then a carton labeling station 332 (Figure 1), where machines of construction well known to those of ordinary skill in the art close and label the carton 306. The carton 306 is then ready for shipment.

## **EMBODIMENTS OF FIGURES 22-34**

**[0129]** Attention is now directed to an article packaging system designated by the reference numeral 350 and represented in Figures 22 and 23. The article packaging system 350 is a processing line for sorting articles, for example in this case potted plants 352, according to size, quality, or other criteria and then for processing and packaging the processed plants. The article packaging system 350 automatically places a covered potted plant into a protective sleeve and then places the sleeved pot into a box or carton for shipping and distribution.

**[0130]** In overview, the article packaging system 350 comprises a service station 356 having a platform or table 358 serving to support a set of unsorted potted plants 352. A sorting station 360 employs a sorter which inspects the potted plants 352 and sorts them in accordance with predetermined criteria such as size, quality or variety or any number of other criteria. The sorting station 360 may be manually operated like the sorting station 26 described herein or it may operate automatically, for example, like the automatic sorting station 28 described herein.

**[0131]** A cover supplying station 362 comprises an automatic cover supplying assembly 364 (Figures 28A-B) for selecting a pot cover 366 and placing the pot cover 366 in an application position for receiving the potted

plant 352, thereby forming a covered potted plant 368. The covered potted plant 368 is then placed on a conveyor 370.

**[0132]** A sleeving station 372, constructed much the same as the sleeving station 184 described herein, is downstream of the conveyor 370 and comprises an apparatus for applying a protective sleeve 374 to the covered potted plant 368 to form a sleeved covered potted plant 376. The sleeved covered potted plant 376 is placed onto a conveyor 378 for further processing. A gate station 380 is a gate 382 which serves to divert the sleeved covered potted plants 376 to a separate first lane 383 and a separate second lane 384 of the conveyor 378 in preparation for being placed in a carton. A gathering station 386 is a first gate 388 and a second gate 390 for stopping and accumulating the sleeved covered potted plants 376 in preparation for boxing. In an alternative embodiment, either the gate station 380 or the gathering station 386, or both the gate station 380 and the gathering station 386, are optional.

**[0133]** A carton feeding station 394 comprises a conveyor 396 for conveying or feeding in direction 398 boxes or cartons 400 which will receive the sleeved covered potted plants 376. A boxing station 404 pushes or conveys the sleeved covered potted plants 376 into an empty carton 400 for shipping. A closing station 408, if present, serves to close and secure by taping, gluing or stapling each full carton 402 in preparation for shipping. The closing station

408 could be automatic or could be manually operated. All stations from the cover supplying station 362 to the closing station 408, inclusive, comprise a single processing stream of the article packaging system 350. The article packaging system 350 may comprise a second processing stream 412 for processing other potted plants sorted at the sorting station 360.

### **EMBODIMENTS OF COVER SUPPLYING STATIONS**

**[0134]** Turning now to Figures 28A-28B, the apparatus comprising the cover supplying station 362 is described in more detail. The cover supplying assembly 364 is an apparatus having a denesting arm 416 for denesting a pot cover 366 from a bin 418 and transferring the pot cover 366 to a receiving position 420 for receiving a potted plant 422. The denesting arm 416 has a grasping end 424 and a pivoting end 426. The grasping end 424 has a shape adapted to fit around a base 428 of one of the pot covers 366 resting in the bin 418 of pot covers 366. The grasping end 424 grasps the base 428 of the pot cover 366, in the preferred embodiment by a suctioning mechanism 430 and disengages the pot cover 366 from the bin 418 of pot covers 366. The arm 416, now carrying a pot cover 366, pivots in direction 432 to a position over the conveyor 370. The suction from the suctioning mechanism 430 is removed, thereby releasing the pot cover 366 and placing the pot cover 366 on the conveyor 370 in preparation for receiving the potted plant 422. The conveyor

370 may be equipped with guide walls 434 to guide the pot cover 366 to a gate 436 to restrain the pot cover 366 in a stationary position. At this position, the potted plant 422 is disposed within the pot cover 366 to form the covered potted plant 368.

**[0135]** The gate 436 is opened. The covered potted plant 368 is released therefrom and travels in direction 438 down the conveyor 370 to the next station. Meanwhile, the denesting arm 416 is pivoted away in direction 440 and is returned to a position to retrieve the next pot cover 366.

**[0136]** Another denesting embodiment of the cover supplying station 362, illustrated in Figures 29A-29B, comprises a cover supplying assembly 364a having a denesting arm 416a for denesting one of the pot covers 366 from the bin 418 and transferring the pot cover 366 to a receiving position 420a for receiving the potted plant 422. In this embodiment, the grasping end 424a of the arm 416a comprises a suction cup 424a which places a suction on an outer bottom 442 of the base 428 of the pot cover 366. The denesting arm 416a pivots away from the bin 418, and the pot cover 366 is removed from the bin 418 and carried to a conveyor assembly 444.

**[0137]** The conveyor assembly 444 comprises a first parallel belt 446 and a second parallel belt 448 having a gap 450 extending lengthwise therebetween. The grasping end 424a with the suction cup 424a is disposed in the gap 450 between the parallel belts 446 and 448 of the conveyor assembly 444.

As the bottom 442 of the pot cover 366 approaches the conveyor assembly 444, the suction from the suction cup 424a is released and, as the grasping arm 424a continues its downward motion, the pot cover 366 is rested gently on the conveyor assembly 444 and is carried by the parallel belts 446 and 448 in direction 452 through the guide walls 434 to the gate 436.

**[0138]** At the gate 436, the pot cover 366 is held stationary while the potted plant 422 is disposed manually or automatically within the pot cover 366, thereby providing the covered potted plant 368. The denesting arm 416a is then available to retrieve another pot cover 366. The cover supplying assemblies 364 and 364a may be equipped with sensors (not shown) to regulate and control the operation of the denesting arms 416 and 416a and of the conveyor assemblies 370 and 444 and gates 436.

### **EMBODIMENTS OF SLEEVING STATIONS**

**[0139]** Turning now to Figures 24A-D, a sleeving apparatus 460 of the sleeving station 372 will be described. The sleeving apparatus 460 comprises a sleeve support assembly comprising a first wicket 462 and a second wicket 464 which bear a set of sleeves 466. The sleeving apparatus 460 is the same as a sleeving station 484 described herein except for the modifications described herein. Each wicket 462 and 464 extends horizontally for a distance, then bends downward diagonally. The sleeving apparatus 460 further

comprises a suctioning tube 468 which applies a suction to a first side 470 of one of the sleeves 466 for loosening and separating the first side 470 from a second side 472 of the sleeve 466 to provide an opening 474 at the upper end of the sleeve 466 (Figures 24A, 24B and 24D).

**[0140]** Air is forced into the opening 474 of the sleeve 466 from an inflator tube 476 and the sleeve 466 is thereby sufficiently inflated to receive the covered potted plant 368. The inflator tube 476 is retracted by an inflator cylinder 477 or by another retracting device (Figure 24B). One of the covered potted plants 368 is then deposited into the open sleeve 466. The covered potted plant 368 may be automatically deposited in the sleeve 466 via a mechanism similar to that shown in Figures 17-18 for the sleeving station 184 described previously. Alternatively, the covered potted plant 368 may be deposited into the sleeve 466 manually by an operator. Alternatively, the potted plant 422 without the cover 366 may be inserted into the sleeve 466, thereby by passing the cover supplying assembly 364.

**[0141]** The suction tube 468 is then retracted into a suction cylinder 478. A resulting sleeved covered potted plant 480 will then slide, via gravity, down the wickets 462 and 464 in direction 482 to a position 483 over the conveyor 378 (Figure 24C). The sleeved covered potted plant 480 may slide onto the conveyor 378 and, by the friction of the conveyor 378 underneath the bottom

442 of the base 428 of the sleeved covered potted plant 480, be carried by the conveyor 378 away from the sleeving station 372.

**[0142]** Alternatively, the sleeving apparatus 460 may be equipped with a disengaging assembly comprising an extendable pushing arm 486 to push the sleeved covered potted plant 480 in direction 485 off the wickets 462 and 464 onto the conveyor 378 (Figure 24D). The sleeved covered potted plant 480 is thereby conveyed upon the conveyor 378 downstream and is ultimately packed into the carton 400. The extendable pushing arm 486 is then retracted by a pushing arm cylinder 488 in preparation for the next sleeved covered potted plant 480. Operation of the sleeving station 372 may be regulated by sensing devices (not shown) opening the sleeve 466 in preparation for depositing a potted plant therein and for maintaining an even and regulated flow of sleeved covered potted plants 480 on the conveyor 378.

**[0143]** The components of the sleeving apparatus embodiments are illustrated in Figures 15-19 and 24A-27B as isolated. However, it will be appreciated and understood by one skilled in the art that the components could be easily and completely attached and assembled together to form a unified apparatus.

## **EMBODIMENTS OF THE BOXING STATIONS**

**[0144]** Referring now to Figures 25-26, the sleeved covered potted plants 480 may be boxed at the boxing station 404 immediately after leaving the sleeving station 372. In one embodiment, the boxing station 404 comprises a boxing assembly 500 and an extendable automatic pushing arm 502 which, while pushing the sleeved covered potted plant 480 off the wickets 462 and 464, proceeds to push the sleeved covered potted plant 480 in direction 504 into the open-sided box or carton 400 resting on an adjacent conveying system 506 (Figure 25). Once the carton 400 is filled, the filled carton 402 (Figure 22) is passed to the closing station 408 for closing and securing. The pushing arm 502 is retracted by a retracting cylinder 508 in preparation for another sleeved covered potted plant 480.

**[0145]** In another embodiment of the boxing station 404 (Figure 26), a boxing assembly 510 has a pivotable automatic gripping arm 512 having a gripping end 514. The gripping end 514 of the gripping arm 512 grips an upper portion 516 of the sleeved covered potted plant 480. The gripping arm 512 is retractable by a cylinder 518 attached to a pivoting brace 520. The pivoting brace 520 is pivoted in direction 522 to a position over a carton 400a having an open upper side and the gripping arm 512 lowers the sleeved covered potted plant 480 into the carton 400a. The carton 400a can then be closed and secured for shipping. Alternatively, rather than having the gripper arm 512

move the sleeved covered potted plant 480 to a specific location in the carton 400a, the gripper arm 512 may only lift the sleeved covered potted plant 480 and the carton 400a may be automatically moved beneath the lifted sleeved covered potted plant 480 to be properly positioned to accept the sleeved covered potted plant 480 lowered thereinto.

**[0146]** Another embodiment of a boxing assembly is designated by the reference numeral 530 and is shown in Figure 33. Sleeved covered potted plants 480 are individually directed into the open-sided carton 400 with a pushing arm 532 in direction 534. Sensors (not shown) detect the positions of the sleeved covered potted plants 480 already within the carton 400 and regulate the action of the pushing arm 532. Once the carton 400 is filled, the carton 400 is closed and secured and moved in direction 536 on the conveyor 396 for shipping. The empty open-sided carton 400 is delivered as a replacement, in one embodiment by an automatic boxing delivery assembly. The extendable pushing arm 532 is indicated in Figure 33 as being driven by a cylinder 538 but it is understood by one of ordinary skill in the art that there are other mechanisms for causing the advancement and retraction of the pushing arm 532.

## **PREINSERTION OF COVER INTO SLEEVE**

**[0147]** Turning now to Figures 27A-B and 30A-D, instead of the potted plant 422 being covered by one of the pot covers 366 prior to insertion into the sleeve 466, the pot cover 366 may be preinserted into the sleeve 466 prior to deposition of the potted plant 422 into the pot cover 366. Figure 27A indicates that the sleeve 466 is opened in a manner identical to that described for sleeving apparatus 460 in Figure 24A. The pot cover 366 is then inserted in direction 550 into the opening 474 of the sleeve 466. The suction tube 468 and inflation tube 476 are retracted and the potted plant 422 is deposited in direction 550 into a cover/sleeve combination 552 in the same manual or automatic manner as that described previously. The sleeved covered potted plant 376 then is conveyed by the conveyor 378 to the boxing station 404.

**[0148]** The pot cover 366 may be placed manually into the sleeve 466, but in the preferred embodiment shown in Figures 30A-30D, a cover supplying apparatus 364b has a retractable cover denesting arm 554 having a suction end 556. The suction end 556 of the denesting arm 554 retrieves one of the pot covers 366 from a bin 418a of pot covers 366 (Figure 30A). The denesting arm 554 is retracted by a cylinder 558 to remove the pot cover 366 (Figure 30B) from the bin 418a. The pot cover 366 is transferred to the sleeving station 372 (Figure 30C) and is inserted into the previously opened protective sleeve 374 (Figure 30D). Suction is removed from the suction end 556 therein releasing

the pot cover 366. The denesting arm 554 is retracted, leaving the pot cover 366 within the sleeve 374 and in readiness for insertion of a potted plant 422 therein using means described herein.

### **EMBODIMENT OF FIGURES 31-32**

**[0149]** Turning now to Figures 31 and 32, another embodiment of the article packaging system is designated by the reference numeral 564. The article packaging system 564 has stations exactly as described for article packaging system 350 as shown in Figures 22-30 and 33 except that the article packaging system 564 employs the same cover supplying apparatus, the same sleeving apparatus and the same boxing and closing devices for all categories of potted plants sorted at the sorting station. The advantage of the article packaging system 564 over the article packaging system 350 is that a single device performs each particular function such as sleeving for all grades or categories. Since duplicate apparatuses are not required for each function, the cost and the space required for the overall system is reduced.

**[0150]** The article packaging system 564, as shown in Figure 31, has a platform or table 566 serving as a servicing station 568 supporting a set of unsorted potted plants. A sorting station 570 employs a sorter (not shown) of the same type as packaging system 350 which inspects potted plants 572 and sorts them in accordance with predetermined criteria such as size, quality, or

variety or any of a number of other criteria. The sorter directs each sorted potted plant 572 to either a first parallel conveyor 574 or a second parallel conveyor 576. Potted plants 572 of a particular category are then accumulated on the first conveyor 574 by a restraining gate 578 or on the second conveyor 576 by a restraining gate 580 until a predetermined number of the type of potted plant 572 is accumulated. When the predetermined number of sorted potted plants 572 is accumulated, the appropriate gate 578 or 580 is opened.

**[0151]** The potted plants 572 are then conveyed to a covering station 584 where a cover supplying apparatus 586 supplies a cover 588 and wherein the cover 588 is applied to the potted plant 572. Each covered potted plant 590 in a particular category is then conveyed to a sleeving station 592 where the covered potted plant 590 is deposited into a sleeve (not shown) in a manner exactly as described herein for the article packaging system 350 and its various embodiments. Sleeved potted plants 594 thus produced are then conveyed to a boxing station 596 such as the boxing station 404, or its other embodiments described for system 350, where the sleeved potted plants 594 are placed in cartons which are then closed and secured for shipment.

**[0152]** Figure 32 shows a version of the article packaging system 564 having a first conveyor 600a, a second conveyor 600b and a third conveyor 600c which lead to the single sleeving station 592. The single sleeving station 592 has rollers 601 and can be rolled or moved in direction 602 or direction 604

between the first, second and third conveyors 600a, 600b and 600c manually or automatically for the purpose of supplying sleeves 606 to potted plants 572 or covered potted plants 590 conveyed thereupon. In this way a single sleeving station 592 can supply sleeves 606 to more than one of the first, second and third conveyor 600a, 600b or 600c and category of potted plants to reduce the cost and space required for the system 564.

**[0153]** Alternatively, rather than having a plurality of separate conveyors such as the first, second and third conveyors 600a-600c conveying covered potted plants 590 to the sleeving station 592, a single conveyor having a plurality of parallel lanes (not shown) could be used. Each parallel lane would have a separately regulated gate (not shown) for allowing accumulation and passage to the sleeving station 592 of a predetermined number of potted plants or covered potted plants 590.

**[0154]** The single sleeving station indicated in Figure 32 is shown as having separate conveyors 608a-608c for conveying the covered potted plants 590 to the appropriate boxing station 596. Each conveyor 608a-608c could direct the sleeved potted plants to a single conveyor (not shown) leading to a single boxing station. Alternatively, each conveyor 608a-608c could direct the sleeved potted plants to a separate boxing station.

**[0155]** As described herein for article packaging system 350, the article packaging system 564 could be modified in a number of ways. For example,

the pot cover could be applied to the potted plant prior to accumulation on the first and second conveyors 574 or 576 by restraining gates 578 or 580, respectfully; or, the pot cover could be placed into the open sleeve 606 prior to the introduction of the potted plant into the sleeve 606, as indicated in the embodiment shown in Figures 27A-B.

#### **EMBODIMENT OF FIGURE 34**

**[0156]** Referring now to Figure 34, another embodiment of the article packaging system referred to by the reference numeral 610 is illustrated. The article packaging system 610 is constructed exactly as described for article packaging systems 10, 350, or 564 or modifications thereof except that a decorative pot cover is directly formed about the outer surface of a potted plant 612 using an appressing cover forming apparatus such as a cover forming apparatus 614 to form a covered potted plant 616 at a point prior to application of a sleeve to the potted plant 612. The cover forming apparatus 614 appresses a sheet of material (not shown) about the external surface of the potted plant 612 to form the covered potted plant 616 having a cover which may or may not be bonded to the external surface of the potted plant 612, as described herein.

**[0157]** The cover forming apparatus 614 which could be used, for example, is one described in U.S. Patent No. 5,291,721 entitled "Cover Forming

Apparatus Having Pivoting Forming Members," the specification of which is hereby expressly incorporated herein. This does not exclude the use of other types of cover forming apparatuses adapted for forming a cover about the outer surface of a potted plant to form the covered potted plant 616.

**[0158]** After the potted plant 612 has been covered by the cover forming apparatus 614, the covered potted plant 616 is transferred to a conveyor 618 moving in direction 620 toward a sleeving station exactly the same as other sleeving stations previously described herein. The relocation of the covered potted plant 616 from the cover forming apparatus 614 can be accomplished manually or automatically such as by a transfer device 621 having an extendable pushing arm 622 or by some other device adapted for moving the covered potted plant 616 to the conveyor 618.

**[0159]** Changes may be made in the combinations, operations and arrangements of the various parts and elements described herein without departing from the spirit and scope of the invention as defined in the following claims.